NOTES from the Marine Biological Station, Plymouth :—Last week's captures include the rare Nudibranch *Hero formosa*, specimens of the spiny shrimp (*Crangon spinosus*), and of the starfishes *Porania pulvillus* and *Henricia* (*Cribrella*) *sanguinolenta*. In the floating fauna *Plutei*, large and small, have now quite taken the place of the *Auricularia* and *Bipinnaria* larvæ, which were so plentiful a few weeks ago. *Arachnactis* is still obtainable. The unmodified ephyræ of *Aurelia* are now very scarce : most of them are passing through various phases of their metamorphosis into the definitive medusa-form ; and, instead of being plentiful everywhere, are now restricted to special localities.

THE additions to the Zoological Society's Gardens during the past week include a Bonnet Monkey (*Macacus sinicus*, ♂) from India, presented by Mr. J. Pitcher ; a Bengalese Cat (*Felis bengalensis*) from Manilla, Philippine Islands, presented by Mr. D. M Forbes, F.Z.S. ; three Peafowls (*Pavo cristatus*, ♂ ♀ ♀) from India, presented by Mr. T. Guy Paget ; a Leadbeater's Cockatoo (*Cacatua leadbeateri*) from Australia, presented by Mrs. W. Everett Smith ; five Black-headed Gulls (*Larus ridibundus*), a Common Gull (*Larus canus*) European, presented by the Rev. E. M. Mitchell ; three Rhomb-marked Snakes (*Psammophylax rhombeatus*), a Hoary Snake (*Coronella cana*) from South Africa, presented by Messrs. H. M. and C. Beddington ; three Spring-boks (*Gazella euchore*, ♂ ♀ ♀) from South Africa, a Raccoon (*Procyon lotor*) from North America, a Green Monkey (*Cercopithecus callitrichus*) from West Africa, deposited ; two silver-backed Foxes (*Canis chama*), a Cape Bucephalus (*Bucephalus capensis*) from South Africa, purchased ; a Short Death Adder (*Hoplocephalus curtus*) from Australia, received in exchange ; four Great Cyclodus (*Cyclodus gigas*) born in the Gardens.

OUR ASTRONOMICAL COLUMN.

COMET SWIFT (*a* 1892).—At the Boyden Station, Arequipa, Peru, during the visibility of this comet, all the photographic telescopes were turned towards it, with the result that a fine series of photographs were obtained. In the Bache 8-inch photographic doublet, fifty-six pictures (20 millimetres to the degree) were taken, sixteen of which "are of the first quality" ; in the 2·5-inch photographic doublet (3·8 millimetres to the degree) twelve satisfactory plates were taken, while in the 13-inch refractor and 20-inch reflector several additional negatives were collected. An examination of the negatives, especially of those belonging to the first series, indicated two important facts, as Mr. A. E. Douglass (*Astronomy and Astrophysics* for March) informs us. (1) That the tail of the comet was composed of luminous masses receding from the head at a measurable rate, and (2) that the form of the tail depended largely on some varying force acting at the head. The former of these results was deduced from measurements of the distance of prominent points (8 points were here used) from the nucleus, and the acceleration he obtained amounted to 477,000 miles per day. In discussing the second fundamental results, he deals with the general characteristics of the tail and the special phenomena within half a degree of the head, separately. The tail he describes as "a bundle of slightly divergent straight streamers, branching from each other and joined to the head by one, two, or three well-marked lines." At the southern part of the tail the photographs showed the appearance of a curious twisting effect, while a number of faint streamers, in many cases not joined to the main part of the tail, were also visible. The curve of the natural tangents of the position angles for the date on which they left the head, is, as plotted out by Mr. Douglass, quite irregular, and suggests "non-periodic outbursts from the head of the comet or variations in the repulsive force of the sun" ; where the tail swings to one side there are "large jets in the opposite direction as if the whole resulted from some increase in activity in the head." He suggests that this activity may be connected with solar disturbances, just as magnetic storms on the earth may be connected with certain classes of sunspots.

PARIS OBSERVATORY IN 1892.—From the annual report on the condition of the Paris Observatory during the year 1892, which was presented to the Council in January last by M. Tisserand, the Director, we gather the following brief notes :

Commencing with a short reference to the late Director, l'Amiral Mouchez, and to the great loss both to the Observatory itself and to astronomical science in general, M. Tisserand informs us that, at the suggestion of M. O. Struve, the presidency of the Comité permanent de la Carte du Ciel has passed to the present Director of the Paris Observatory. This choice has been received very favourably, and been confirmed by all the members of the committee. Let us here tender our congratulations to M. Tisserand, who, without doubt, will, in his capacity as president, bring such a grand work as nearly as possible to perfection. In fact, he has commenced by increasing the personnel du Bureau de Mesures des Clichés at the Observatory, and constructing a new machine for the measures, while he hopes soon to publish a fascicule of the *Bulletin de la Carte du Ciel*, which will contain the method of reducing the measures, and of the definite computations of the positions of the stars.

The large equatorial Coudé has this year been subjected to a minute study by M. Lœwy from the point of view of its optical qualities, and of the possibility of improving it still more. The experiments have as yet been restricted to the mounting of the mirror, and it seems that important results may soon be forthcoming. The spectroscopical department, under the direction of M. Deslandres, has, as we are informed, quite assumed a definite form since its foundation in 1890 ; the work done is tabulated under the three headings—sun, stars, and laboratory work. As we have previously referred in these columns to most of the work here accomplished, such as, for instance, the researches of the velocities of stars in the line of sight (250 stars will here be included), photographs of protuberances, faculæ, new hydrogen radiations, &c., further notice will be unnecessary. With the Equatorial de la Tour de l'Ouest, the programme of observations has been the same as in previous years, measures of the positions of comets, nebulæ, and double stars having been obtained. Among the observations here recorded as many as 136 were made of Comet Swift (1892), 41 of Comet Denning (1892), while 250 nebulæ and 120 double stars have been measured. All the above were made by M. Bigourdan. M. Faye also made 77 observations of comets. With the Cercle Méridien du Jardin under the special service of M. Lœwy, the total number of observations amounted to 16,686 ; 453 observations were made of the sun, moon, and planets. M. Paul and Prosper Henry have been occupied in obtaining clichés of the international chart and of the catalogue ; photographs have also been taken of the late nova in Auriga, Jupiter, and Comet Holmes. The Bureau des Mesures des Clichés du Catalogue, under the direction of Mdlle. Klumpke, has been very busy. At this part of the report a brief description of the measuring machine is given, and in a paragraph on "reflexions sur le catalogue et la durée de son exécution," we are told that, if simply the 1200 or 1400 clichés which are demanded for the work in each of the eighteen observations are obtained "on peut espérer d'y atteindre en cinq ou six ans au plus." For measuring the clichés with one machine, and two persons to observe and write the results, 130 clichés could be done in a year, but it would take about 10 years to measure the clichés attributed to one observatory, with one machine and two persons working incessantly. The report contains also all the meteorological work and that done with the minor instruments, concluding with the usual lists of personal publications, observatory publications, changes in the personnel, &c.

THE LARGE NEBULA NEAR ξ PERSEI (N. G. C. 1499).—Dr. F. Scheiner, in *Astronomische Nachrichten* (No. 3157), describes briefly this great nebula near ξ Persei, several photographs of which he has been able to obtain. During November and December last, employing an objective of 4-inch aperture, he took fine photographs, with exposures varying from 1 to 6 hours. The longest exposed plates showed that the size of this nebula has been considerably under-rated, and that it comes nearly up to that of Orion and Andromeda. This nebula, it will be remembered, was discovered by Prof. Barnard with a 6-inch objective, and the position which he gave, 3 h. 54·0 m. R.A. + 36° 1′ Decl. (1855·0), referred to

© 1893 Nature Publishing Group

the more northern part. Dr. Scheiner's photographs show that its extension southward is very considerable, but, owing to its dimness, was not seen by Prof. Barnard. The form of this nebula, a copy of which is given in this number, is inclined to be spirally, although not so apparent as that of Andromeda, and, curiously enough, it lacks a bright nucleus, as in the latter.

MINOR PLANETS.—The work of discovering minor planets seems, at the present time of the year, to be in a very flourishing condition, although rather restricted to two observers, according to the current number of *Astronomische Nachrichten* (No. 3157). Charlois with 10 and Wolf with 2, bringing the present notation up to 1893 *x*, is a good number for the first quarter of the year, and if this average be kept up we shall soon be driven to indulge in the Greek or German alphabet, or both.

GEOGRAPHICAL NOTES.

MR. JOHN BARTHOLOMEW, of Edinburgh, whose reputation as one of the foremost British map-makers is world-wide, died on March 30, at the age of 61. His career will be remembered as an epoch in the history of the perfecting and popularising of English maps. Trained in Edinburgh and afterwards under the late Dr. Petermann, in London, Mr. Bartholomew succeeded his father in a cartographical business in Edinburgh, which he steadily enlarged and improved, paying attention not only to excellence of mechanical production, but to the improvements of methods of representation. But the leading characteristic of Mr. Bartholomew's work was his conscientious endeavour to produce the most accurate topographical delineation. The general use of maps coloured orographically in this country is mainly due to the efforts of the Edinburgh Geographical Institute, of which he was the head. Mr. Bartholomew gradually withdrew from active work on account of failing health, and his son, Mr. J. G. Bartholomew, has taken his place in the Geographical Institute.

MR. THEODORE BENT (see p. 519) has been able to reach Aksum, where, however, he only remained for eight days, on account of tribal wars. The party had to retire abruptly because of a threatened fight, in which they were very nearly compelled to take sides, but fortunately the report of an advance of Italian troops to their relief solved the difficulty, and they reached the coast in safety. Despite the shortness of the working time, some good archæological results have been obtained.

THE March number of *Petermann's Mitteilungen* contains a valuable paper on North-west Patagonia by Dr. J. von Siemiradzki, with a map showing the results of his surveys and coloured to bring out the pastoral possibilities of the region. His route in 1891–92 led up the Rio Negro and Rio Limay to Lake Nahuel-Huapi and thence northward through the grassy valleys and bare slopes of the Cordillera to the Upper Biobio valley, whence the expedition passed to the coast of Chile.

THE Royal Geographical Society has given a grant to Dr. H. R. Mill to defray the expenses of a careful bathymetrical survey of some of the larger English lakes. The work, which will be carried out next summer, would be greatly facilitated if use could be had for a few days of a steam launch upon any of the lakes. Windermere, Coniston Water, and Wastwater will probably be sounded in the first place, as they are the most interesting from the limnological point of view.

A PAPER on the Geography and Social Conditions of the Iberian Peninsula read at the March meeting of the Berlin Geographical Society by Prof. Theobald Fischer is published in abstract in the April number of the *Geographical Journal*. The paradoxical character of the peninsula in the variety of its conditions has long been known. The great central plateau with its broken mountain border sloping steeply to the sea throws the bulk of the population towards the coast-line. In the border zone of the peninsula comprising 45 per cent. of its area, more than 66 per cent. of the inhabitants are settled. The only large city in the central plains is Madrid; all the rest of the plateau is occupied by wheat-growers and sheep-rearers; the mining, fruit-growing and industrial interests being all confined to the seaward slopes. There are few parts of Europe in which the physical conditions so plainly dominate the whole character of a country.

GRAPHICAL SOLUTIONS OF PROBLEMS IN NAVIGATION.

1. IF we suppose the two angles P, S of a spherical triangle SPZ to be together less than two right angles, a plane triangle $S_1P_1Z_1$ may clearly be drawn such that $P_1 = P$ and $S_1 = S$. The sides of the spherical triangle PS, PZ, SZ being respectively denoted by p, c, z, those of the plane triangle may be taken in the following ratios:—

$$P_1S_1 = \tan \tfrac{1}{2}p,$$
$$P_1Z_1 = \tfrac{1}{2}\tan\tfrac{1}{2}(c+z) + \tfrac{1}{2}\tan\tfrac{1}{2}(c-z),$$
$$S_1Z_1 = \tfrac{1}{2}\tan\tfrac{1}{2}(c+z) - \tfrac{1}{2}\tan\tfrac{1}{2}(c-z),$$

These results may be easily verified.

Hence $$S_1Z_1 + P_1Z_1 = \tan\tfrac{1}{2}(c+z),$$

and $$P_1Z_1 - S_1Z_1 = \tan\tfrac{1}{2}(c-z).$$

From these equations we infer that Z_1 is the intersection of an ellipse and hyperbola which have the same foci P_1 and S_1. Suppose now that the line S_1P_1 contains, say, 100 divisions, and that a system of ellipses, having S_1 and P_1 as foci, with major axes 101, 102, 103 . . . and a system of hyperbolas whose axes are 99, 98, 97 . . . are drawn on one side of S_1P_1; then, by finding m_1, m_2 from the equations

$$m_1 = 100\tan\tfrac{1}{2}(c+z)\cot\tfrac{1}{2}p,$$
$$m_2 = 100\tan\tfrac{1}{2}(c-z)\cot\tfrac{1}{2}p,$$

we should be able to localise the point m_1m_2 as coming between two successive ellipses and also between two consecutive hyperbolas in the diagram.

2. The usefulness of such a diagram lies in its application to problems in navigation. For p may be taken as the north polar distance of the sun, z the complement of his altitude, and c the colatitude of the place of observation. Having determined m_1, m_2 and thus localised Z_1 in the diagram, the angle $Z_1P_1S_1$ is the hour angle which may be suitably measured.

If we interchange p and c in the diagram, thus making P_1 and Z_1 the foci, the point to be localised is S_1 from the equations

$$n_1 = 100\tan\tfrac{1}{2}(p+z)\cot\tfrac{1}{2}c,$$
$$n_2 = 100\tan\tfrac{1}{2}(p-z)\cot\tfrac{1}{2}c.$$

The difficulties attending this mode of representation will present themselves in another form in § 4. It is sufficient to notice here that this use of the diagram has the advantage of giving two useful angles—$S_1P_1Z_1$, the hour angle, and $S_1Z_1P_1$ the azimuth.

3. The merit of both these modes of representation consists in their being each a single diagram, applicable at any time of year, though in northern latitudes more favourable to accurate measures in summer than in winter. Their demerit consists in the preliminary calculations of m_1, m_2, or n_1, n_2. This, however, might be minimised by supplying, along with the diagram, tables of the values of m for two arguments θ and ϕ given by

$$m = 100\tan\tfrac{1}{2}\theta\cot\tfrac{1}{2}\phi$$

The whole amount of preliminary calculation would then consist in adding and subtracting p and z, and looking out m_1 and m_2.

I shall now investigate the nature of a diagram which requires no preliminary calculation.

Returning to the spherical figure SPZ, let us suppose SP to be fixed while the sides PZ, SZ vary so that Z describes a curve on the sphere. The corresponding point Z_1 will describe a corresponding locus on the plane. For example, if L describes a small circle with P as centre, the locus of Z_1 will be given by

$$\tan c = \tan\{\tfrac{1}{2}(c+z) + \tfrac{1}{2}(c-z)\}$$
$$= \frac{P_1Z_1}{1 - P_1Z_1^2 + S_1Z_1^2}.$$

Now, if we draw a perpendicular Z_1N to the side P_1S_1 we shall have

$$P_1S_1^2 - S_1Z_1^2 = P_1N^2 - S_1N^2$$
$$= \tan\tfrac{1}{2}p(2P_1N - \tan\tfrac{1}{2}p);$$
$$\therefore\ P_1Z_1 = \tan c\tan\tfrac{1}{2}p(\operatorname{cosec} p - P_1N).$$

This shows that the curve described by Z_1 is a conic section of eccentricity $\tan c \tan\tfrac{1}{2}p$, with focus at P_1 and directrix perpendicular to P_1C_1 at a distance cosec p from P_1.

Similarly, the curves corresponding to small circles about S_1 are conics with a common directrix and with focus at S_1, their curvatures being turned the opposite way from those about P_1.

© 1893 Nature Publishing Group